JEY Labs

Modern[b] Multimeters

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K6JEY

For Comparison

Fluke 8060A

1981 vintage

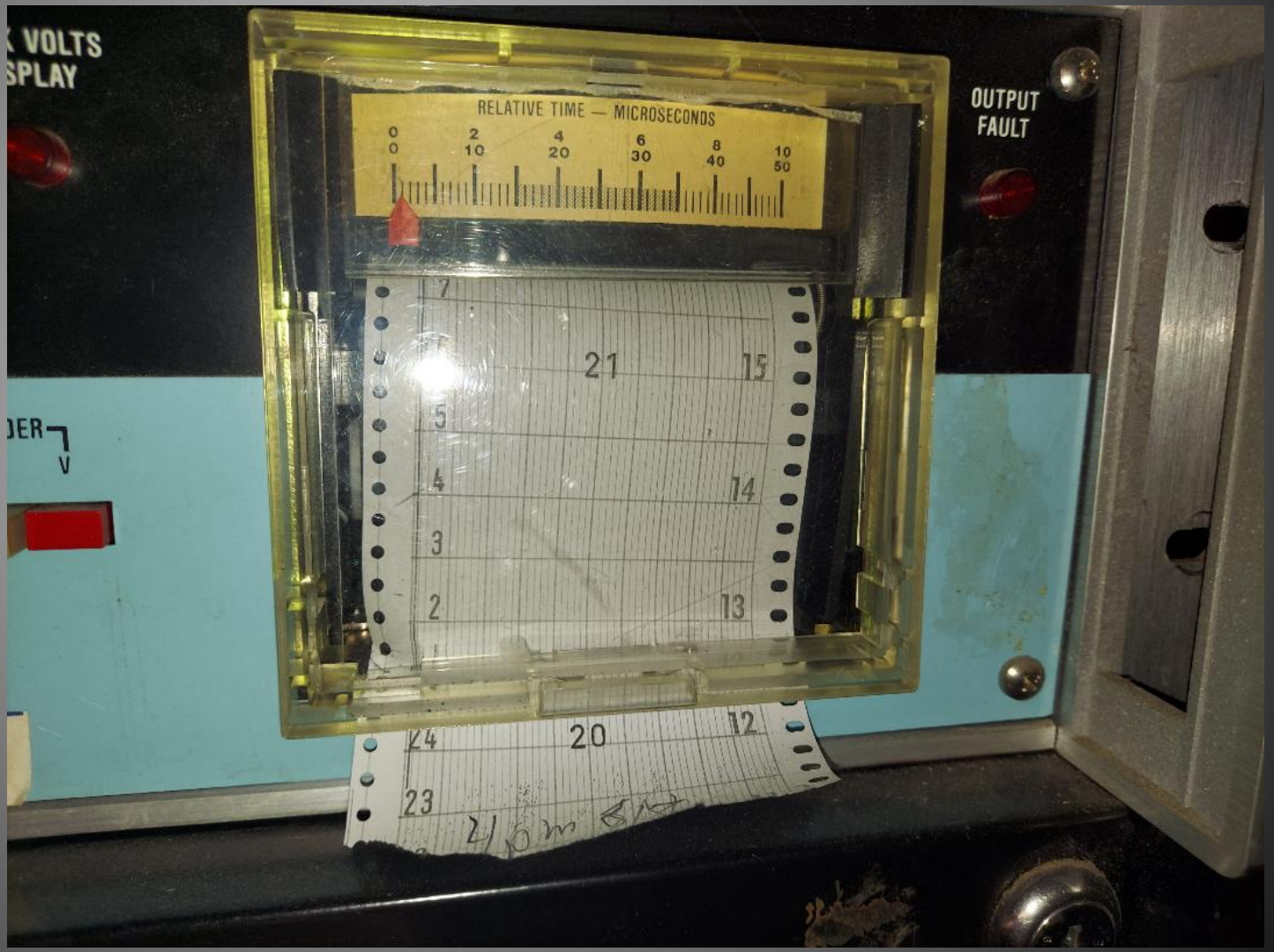
Does dB
relative to 600Ω

No data logging

Rustrack Data Logging

This was easier than Industrial units.

Most were digital Versions of this with Poor interfaces.



Modern DMM's

- **A lot is changing and will change.**
  - External data logging programs via
    - USB, LAN, Bluetooth and Wi-Fi.
  - Better displays
    - TFT with excellent contrast
    - Colors
    - Much more information
  - Firmware updates
  - DBm measurements referenced to Z

Some Measurement Examples

- Use a receiver output with a multimeter for sun and moon noise measurements
- Use an HP8970A/B with sp. Functions 9 for Sun and Moon noise measurements plus documentation.
- Power measurement from the DC jacks/ recorder output on a power meter. (eg HP437, Anritsu)
- Frequency drift over time on your radio.
- Measurements can be in dBm or dBV at a fixed resistance and to a reference level.

Focus of the Talk

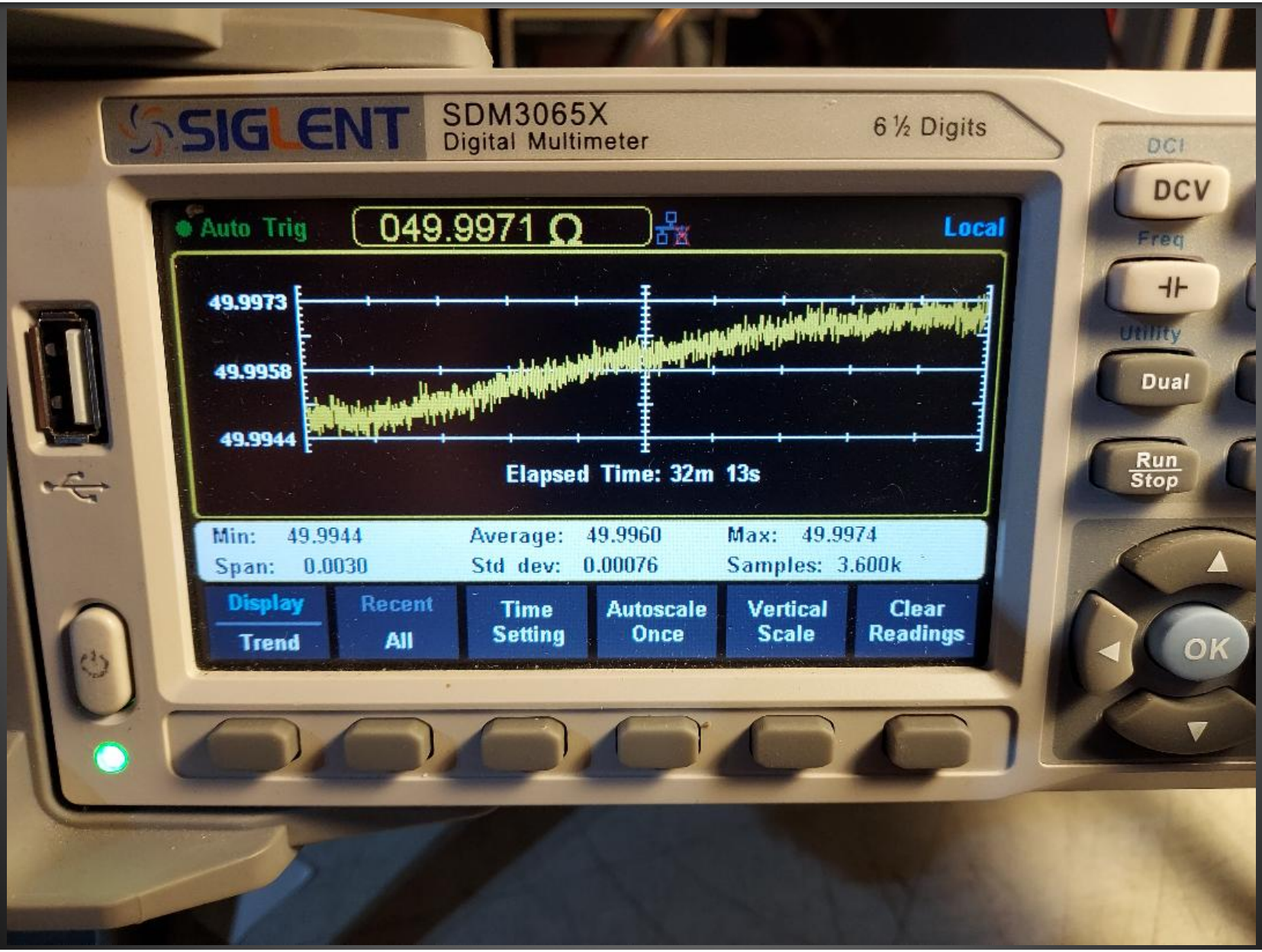
- 7 Different meters
  - Siglent SDM3045x 4 ½ digit (60K counts)
  - Agilent 34410A 6 ½ digit
  - Uni-T UT181A handheld 4 ½ digit. (60K counts)
  - Uni-T UT 61E+ handheld 4 ½ digit (22K counts)
  - Uni-T UT60BT Handheld (9.9k counts)
  - AN9002 Handheld (6K counts)
  - MEET Pencil DMM

Siglent
SDM3045,55,65

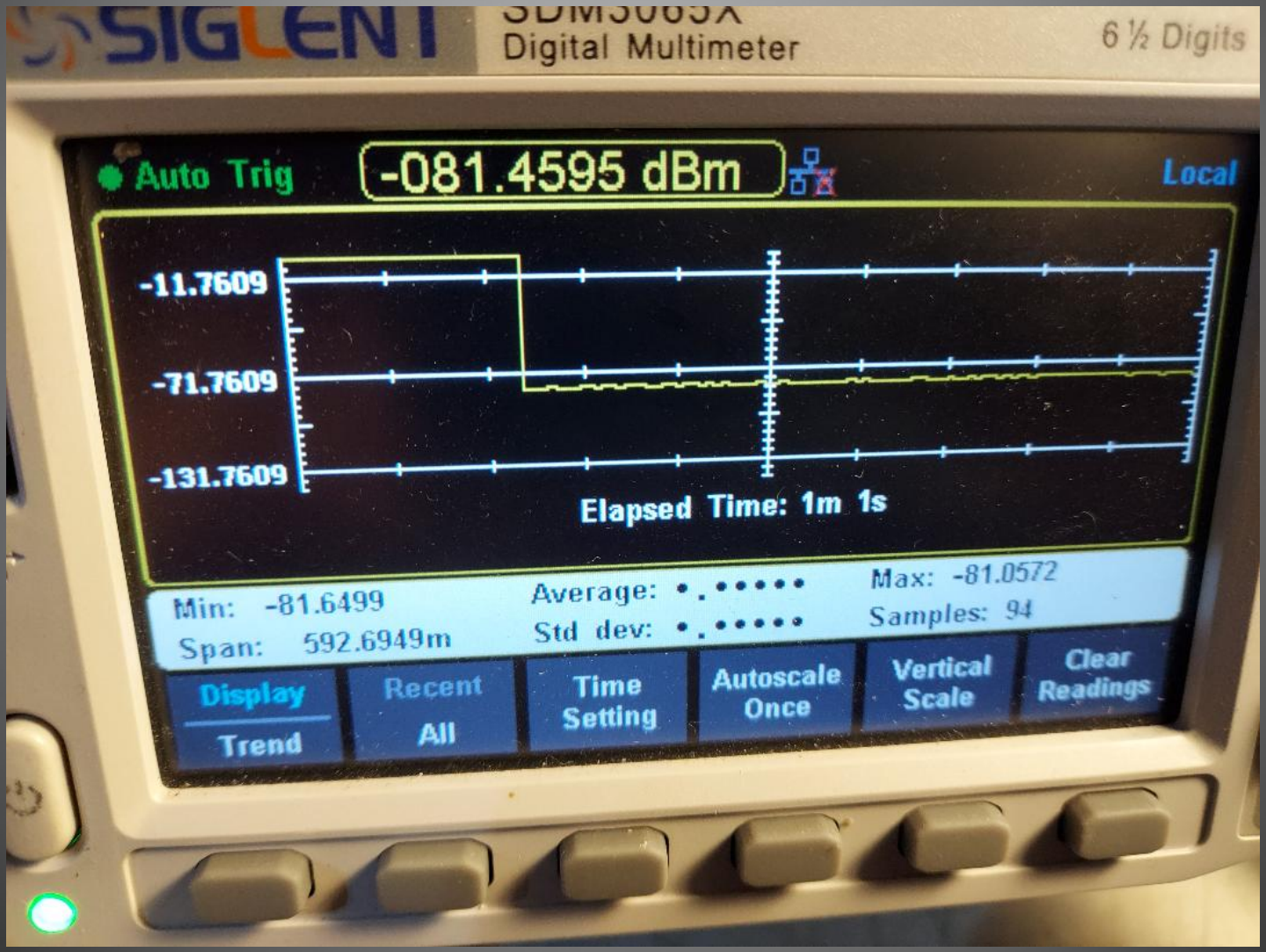
- Very similar to an Agilent 34461A ($1,300+)
- Does data logging and trend analysis live. 1Gb of memory and thumb drive.
- Does dBm at Z or dBV
- Simple Recalibration
- 1GB of memory +USB

  - **4 ½ digit $300**
  - **5 ½ digit $450**
  - **6 ½ digit $600**

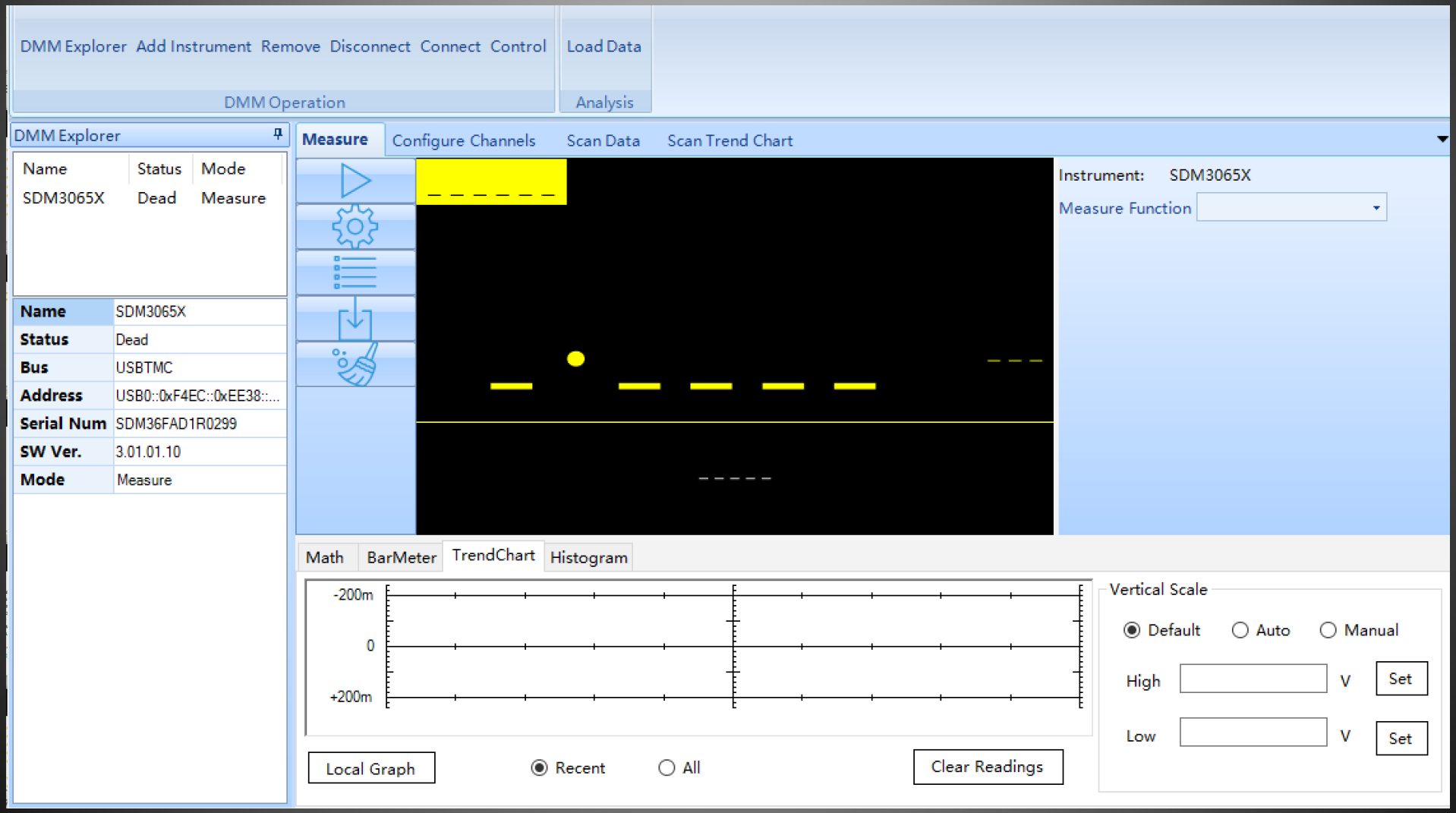
Trend Display
Data Logging



Siglent dBm

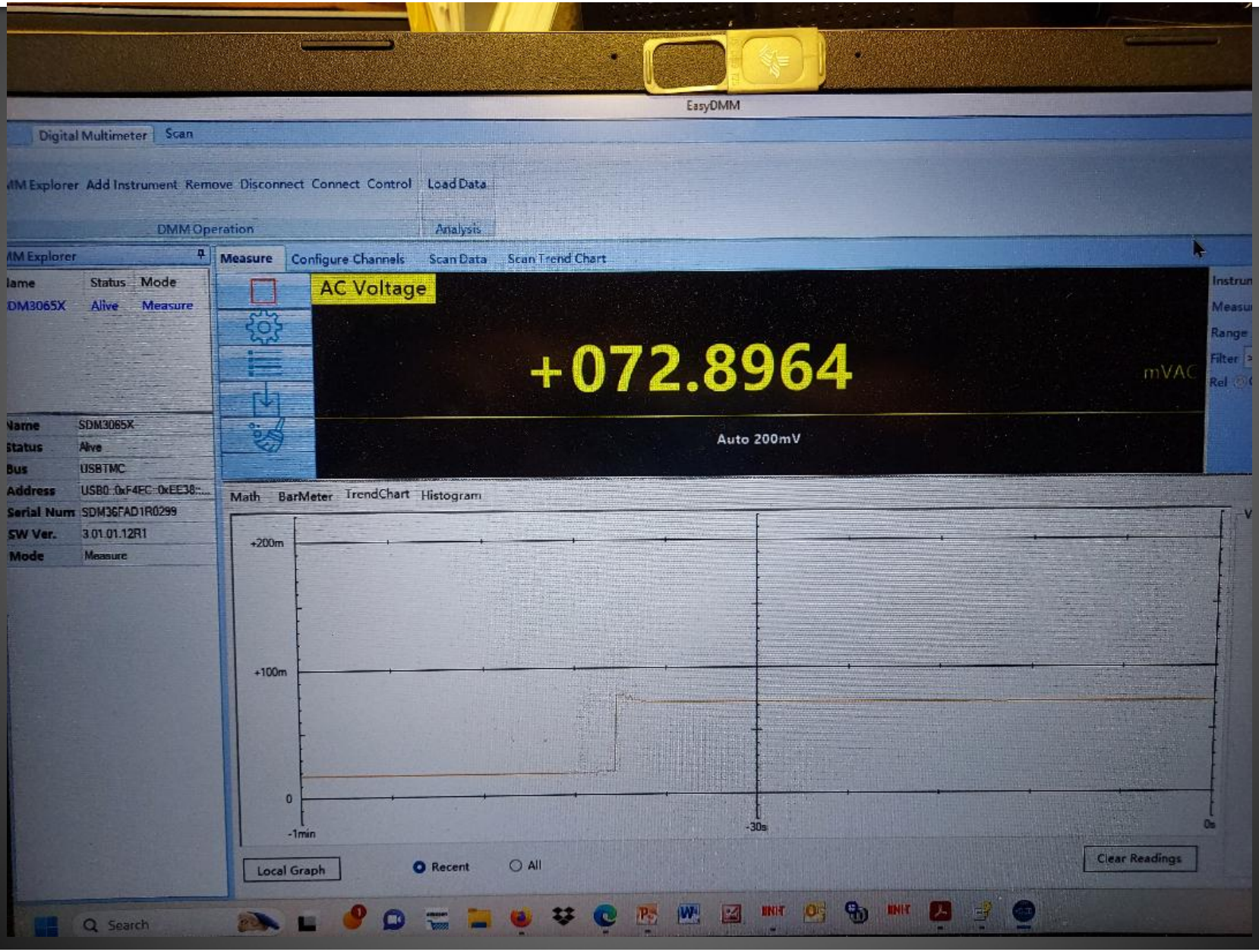

SIGLENT
SDM3065X
Digital Multimeter
6 ½ Digits
Auto Trig
-081.4595 dBm
Local
-11.7609
-71.7609
-131.7609
Elapsed Time: 1m 1s
Min: -81.6499
Average: •.•••••
Max: -81.0572
Span: 592.6949m
Std dev: •.•••••
Samples: 94
Display
Trend
Recent
All
Time Setting
Autoscale Once
Vertical Scale
Clear Readings

Siglent DMM Explorer Program

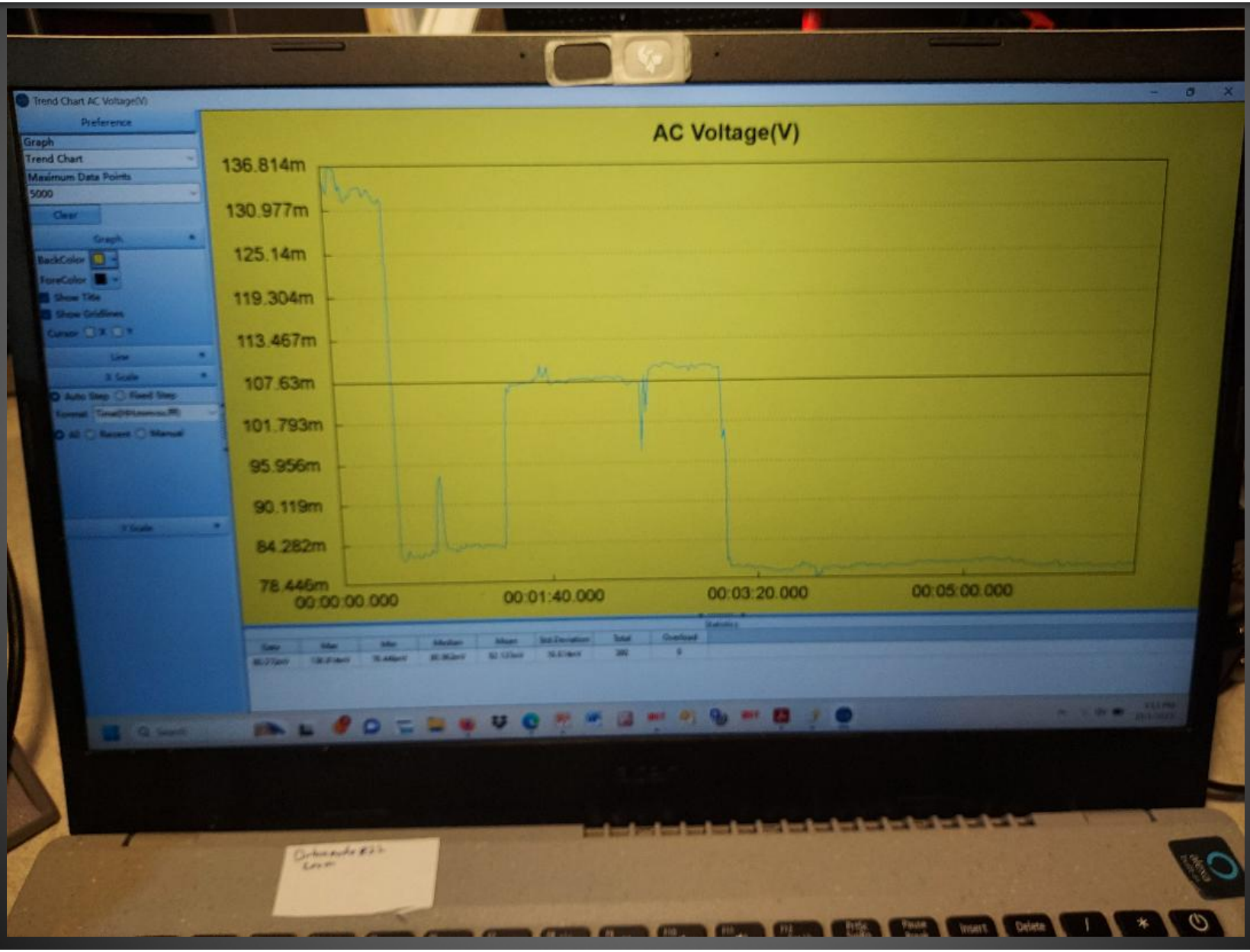


DMM Explorer Trend Data

Via USB



Local Graph


Trend Chart AC Voltage(V)
Preference
Graph
Trend Chart
Maximum Data Points
5000
Clear
AC Voltage(V)
136.814m
130.977m
125.14m
119.304m
113.467m
107.63m
101.793m
95.956m
90.119m
84.282m
78.446m
00:00:00.000
00:01:40.000
00:03:20.000
00:05:00.000

Agilent 34410A

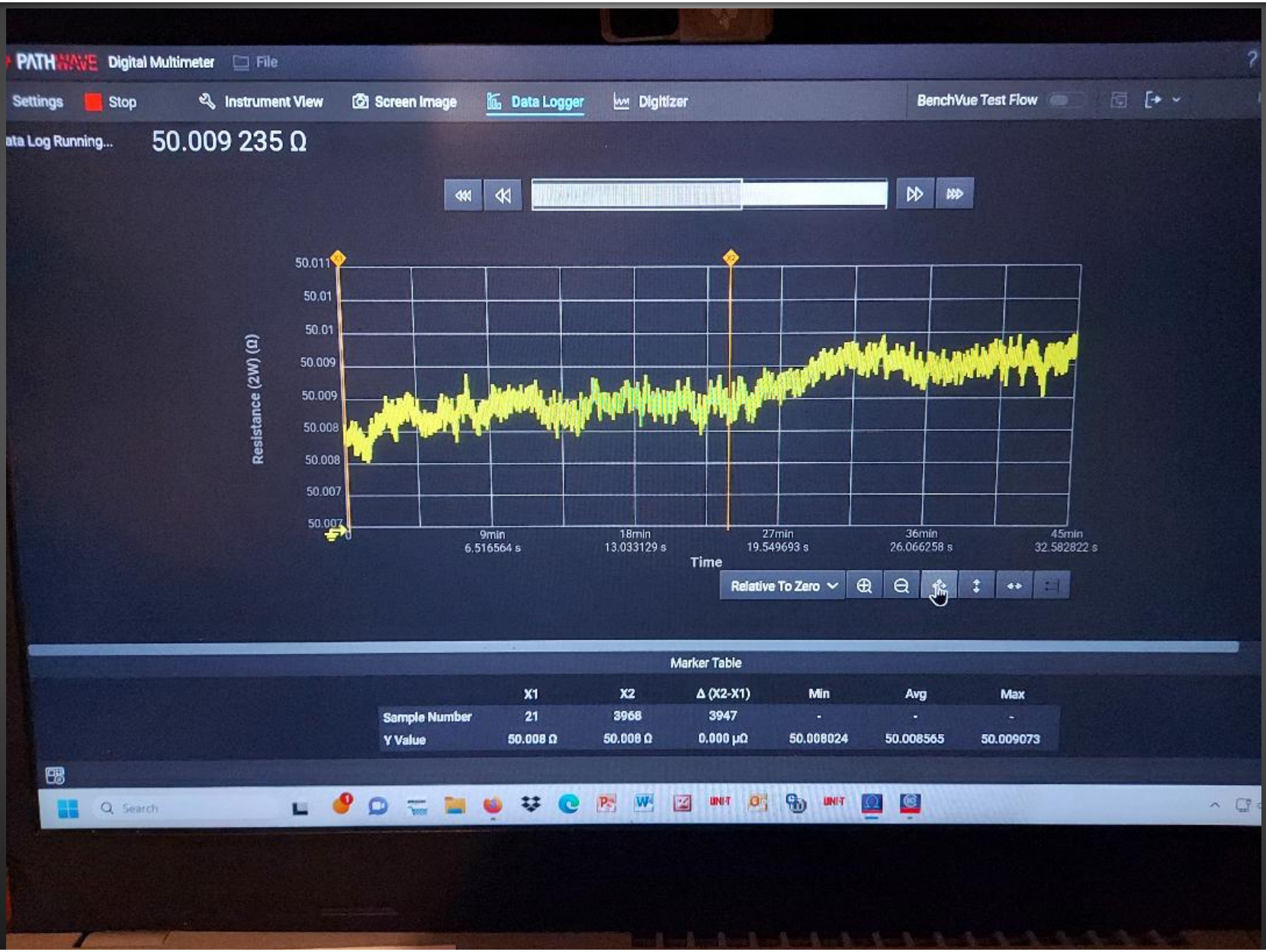
- Updated (2005) and improved 34401a (1993)
- Internal data logging program via LAN.
- Internal averaging
- Other models have
- Auto calibration and data logging trace. ($$$)

- External Pathwave DMM prog via USB or LAN. Has excellent graphing.
- The dBV or dBm ref. to Z. is easy. **Get free basic version.**

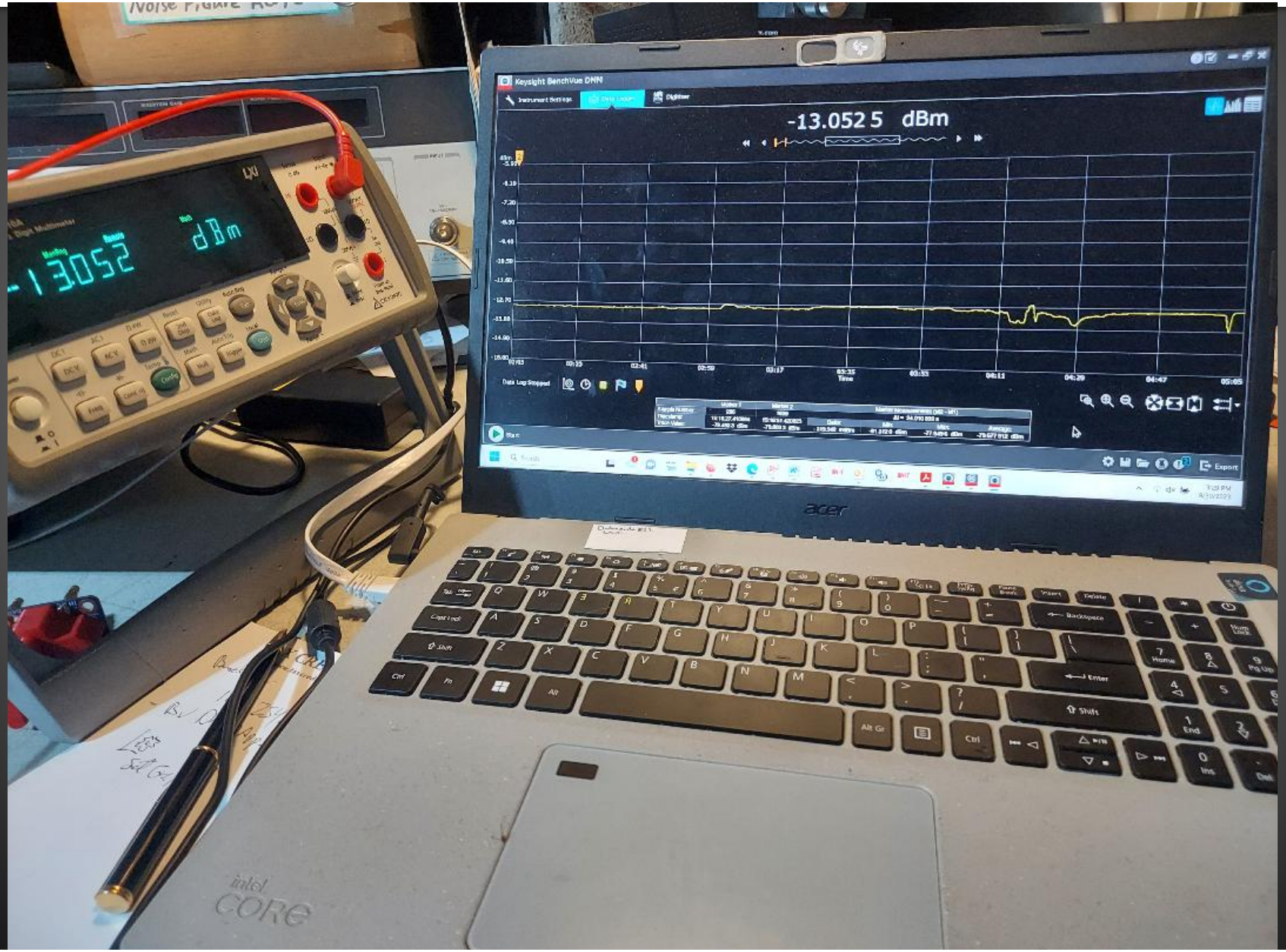
Keysight Pathwave

- First rate program
- Averaging gives you one more digit (34461a)
- Get Pathwave as a free download.
- Regular BenchVue is $65/yr.
- LAN and USB connections are easy
- LAN can conflict with Wi-Fi.

Pathwave DMM Free version



BenchVue DMM Paid App and 34410A



HP34410a Remote Mode

- Run LAN/USB cable to computer in Pathwave DMM app.
- LAN to portable Wi-Fi router should also work
- Great for working on antennas and monitoring the radio.

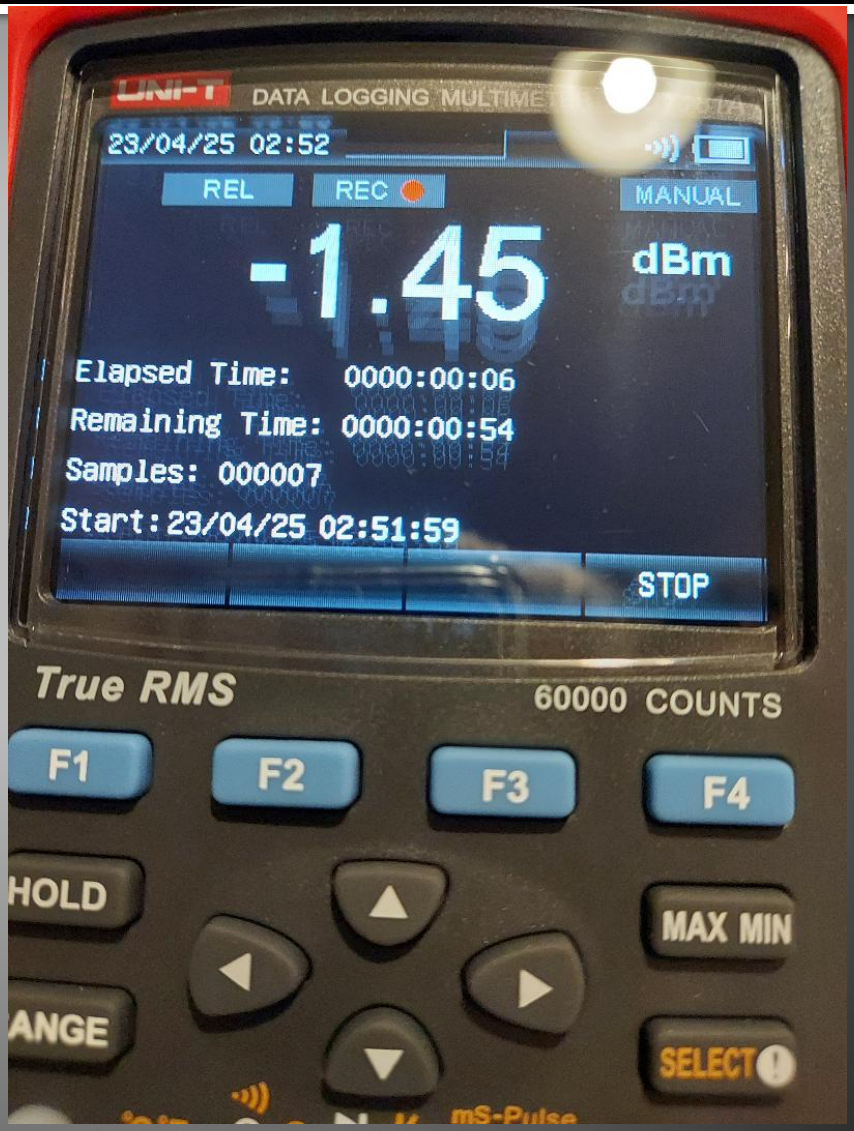
Agilent 34401a Notes

- 34401a
  - Uses a Null Modem-DB9 connection.
  - Startech.com FTDI to null modem DB9 adapter cable should work. $45
  - Keysight serial cable instructions-
- Keysight Serial cable Instructions
  - Meter will measure dBm.
  - Excellent meter but 1993 vintage ($200)

UNI-T 181A

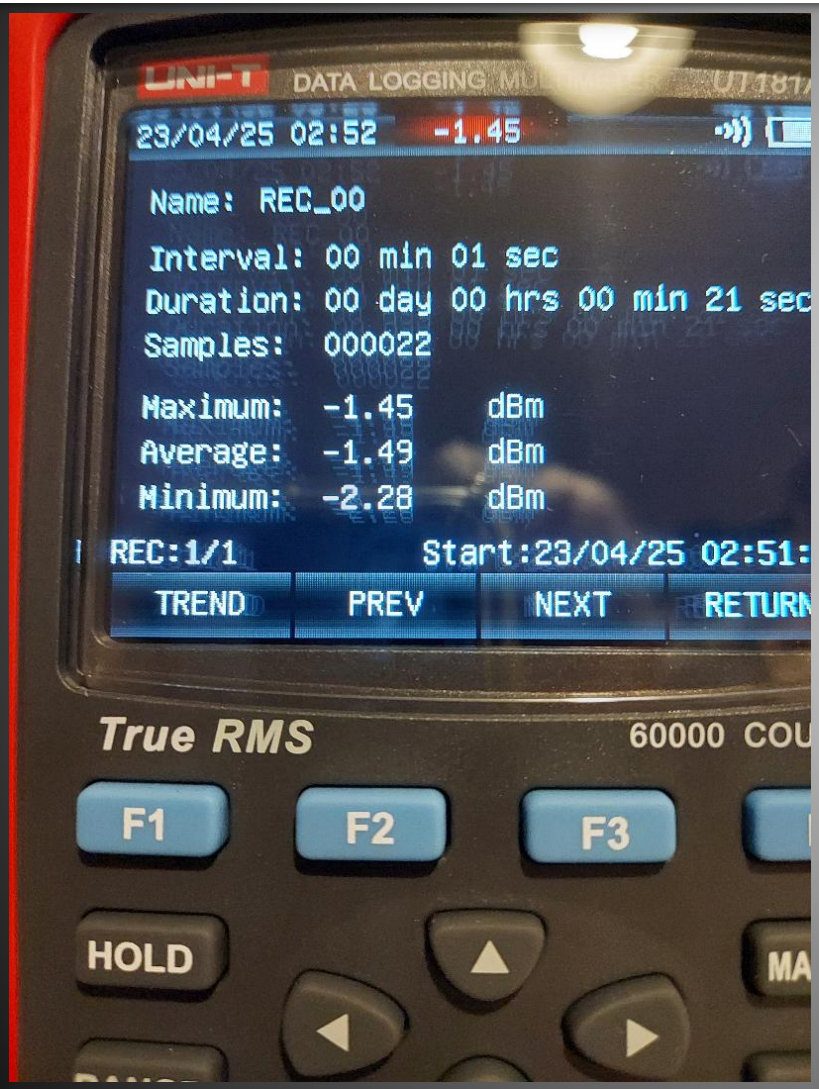
- Hand held
- Bigger than average.
- Excellent sharp display
- Extensive data recording
- Accurate and very fast
- External USB/Bluetooth
- Firmware upgradable
- Recording and graphing are internal and External.
  - **About $280**

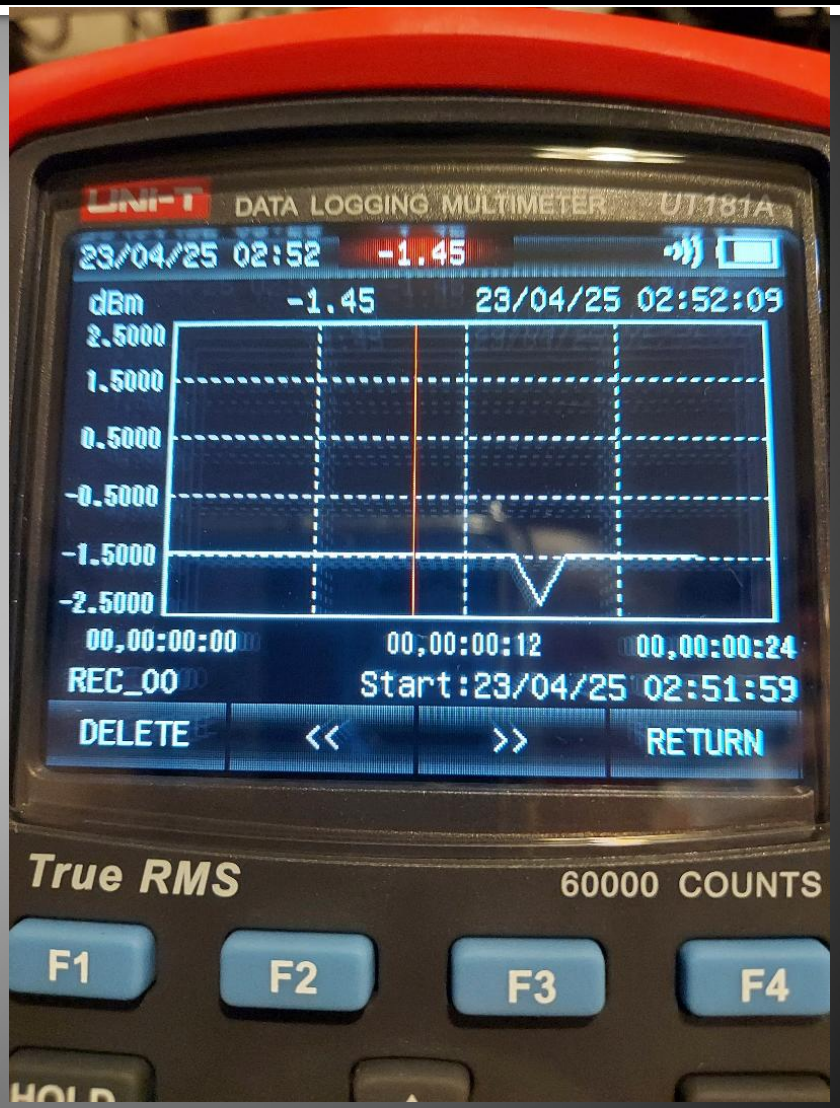
Relative dBm at Z and Record



DBM referenced to Z

Save and Trend Views



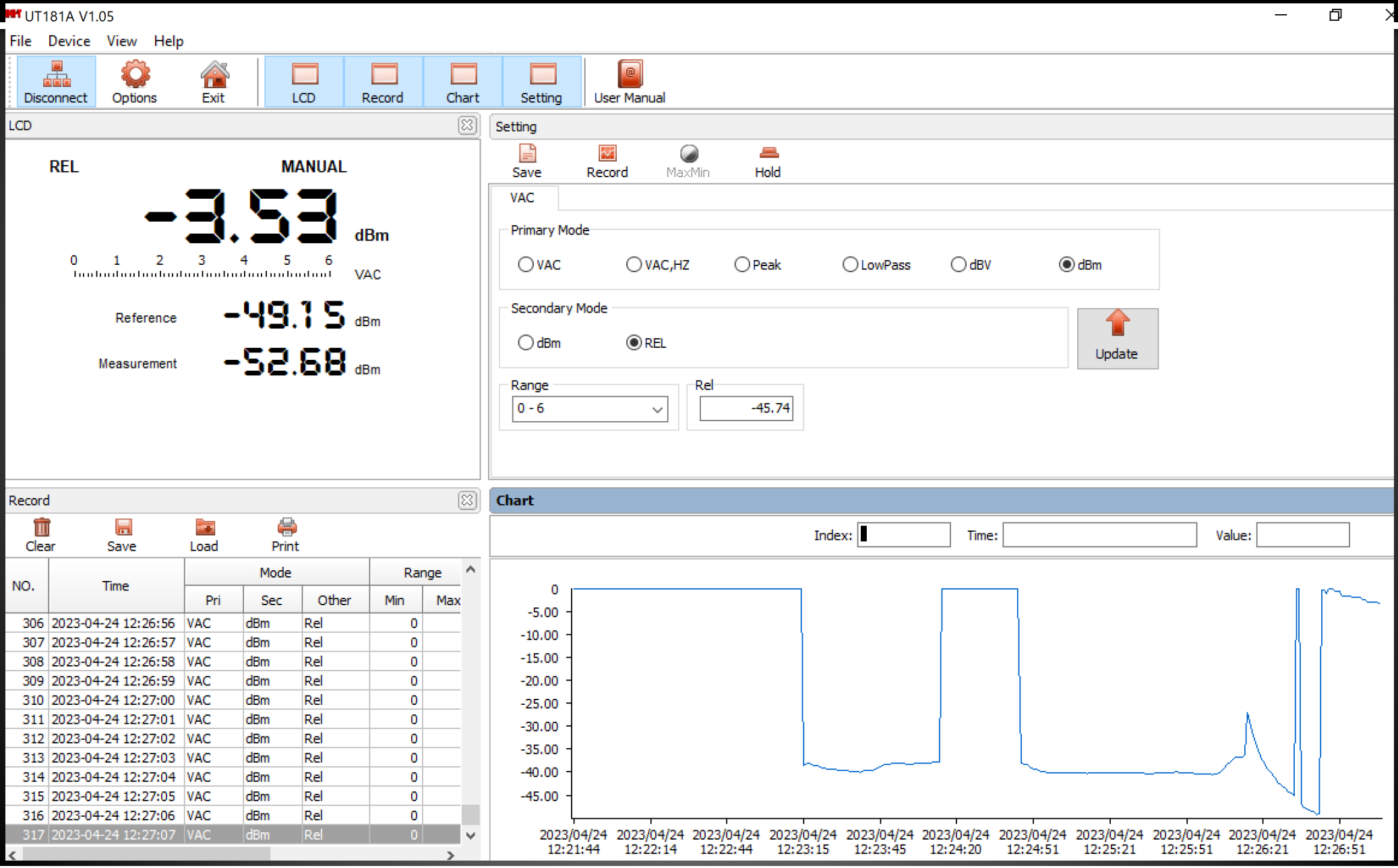


UT181A

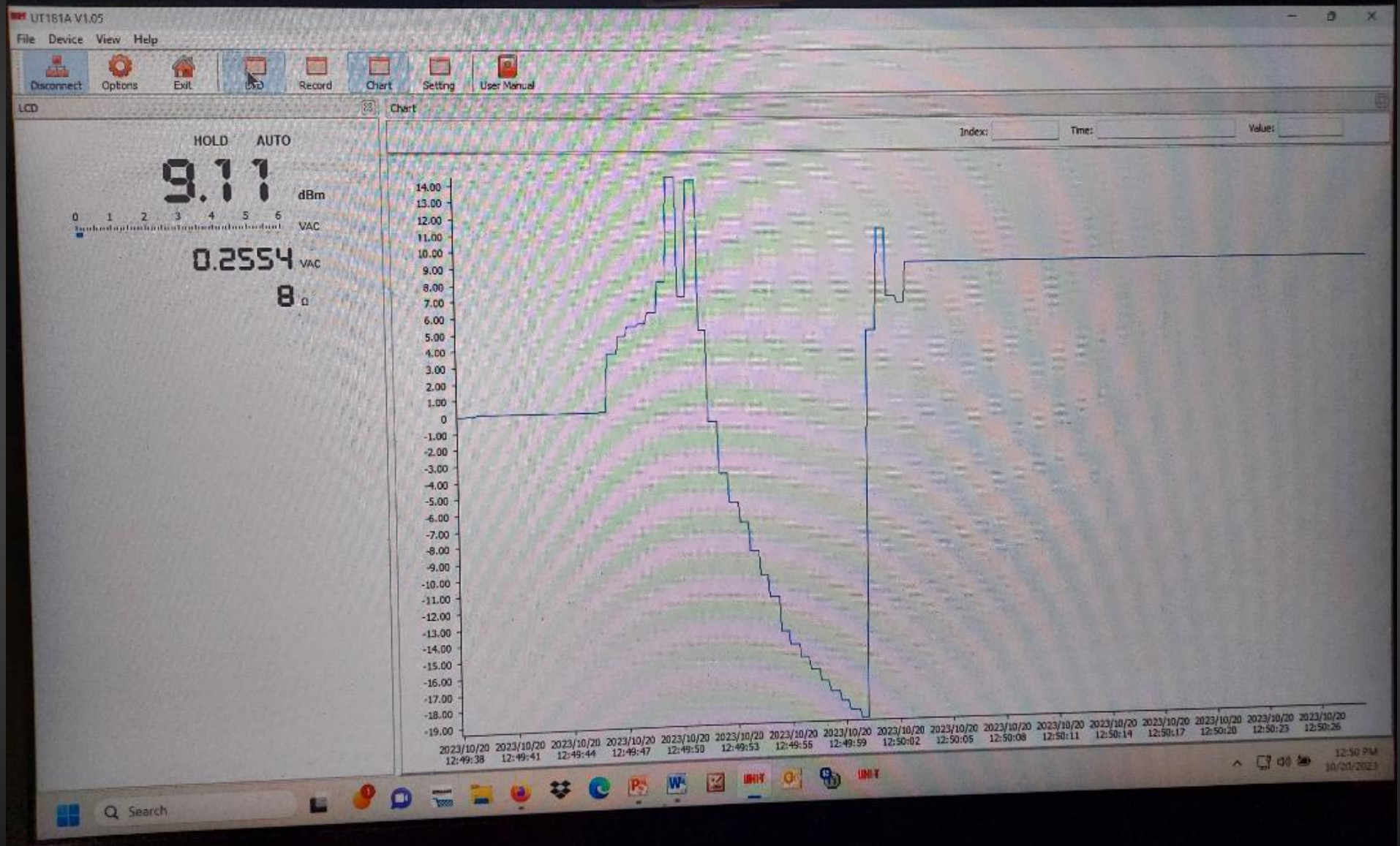
Data Logging

Use either
Internal data display or
External program via USB
Or via ***Bluetooth to Android***
Easy set up! Live graphing.
Record data then get graph.
Use up and down to scale graph.
dBV or dBm
20,000 data point memory.

Software for UT181A



UT181 dBm Measurement Chart



UNI-T Program Notes

- Chart can be full screened. Auto scaled.
- Window sections can be opened or closed.
- The Bluetooth programs are excellent.

Bluetooth Adapter

Works well with UNI-T and *Android or Apple* Data program BT 4.0

Adapter **$30**

UT 181A via Android

You don't have
To be at the
Meter to read it!!

Recording live
in dBm
Try- the meter
at the radio
and
The Android
at the antenna
Data saved on
Phone and DMM

UNI-T 61E+

- UNI-T 61E+ **$85**
  - Very accurate excellent Meter.
  - Has Relative measurement
    - Relative AC V measurement
    - No dBm measurement
    - No internal data logging
  - Has same Bluetooth adapter
  - and excellent program.
  - 22,000 counts
  - $250 cheaper than UT 181

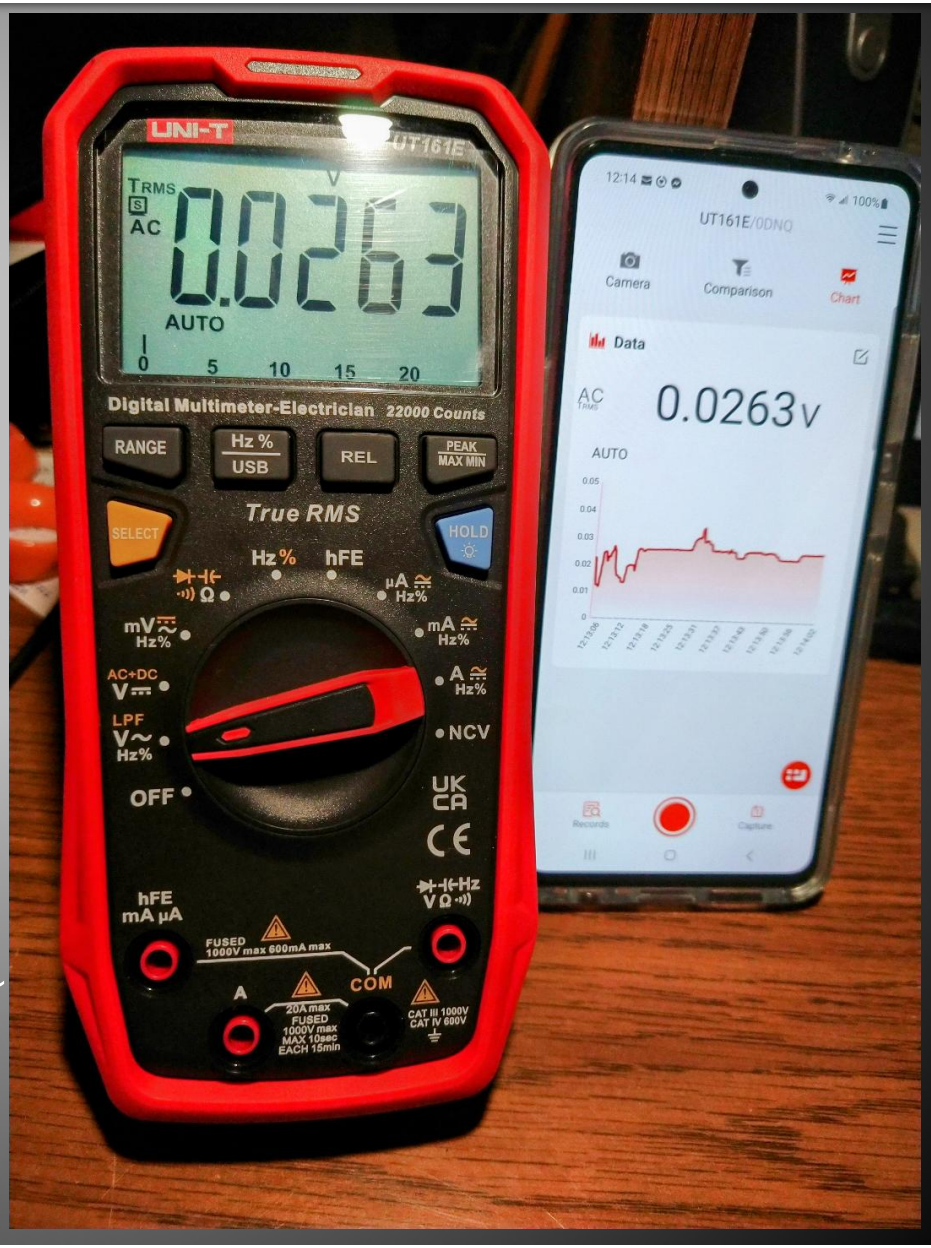
Android display Via Bluetooth

For dBV readings

1. Zero with relative button in AC volts position.
2. Observe peak hold on chart.
3. Calculate dBm from AC voltage difference.

Comes with calibration cert.

4. Order one that comes with a case.



Uni-t UT60BT

- Very cheap at **$40**
- Internal Bluetooth
- More limited
- Same program
- 9.9k counts

AN9002

- Cheap at $50
- Excellent ext. Program
- Internal Bluetooth
- Slippery case.
- Cheap leads
- Display Lens not protected.
- Good display, though.
- 6k counts

MEET- Pencil DMM

- Relative and hold
- Bluetooth for external analog type meter.
- “ DMM
- without test leads”
- Data logging,
- and graphing
- Takes pictures of the setup.

$35 Amazon

“MSBDTP1A”

Meter and Phone

Turn the phone clockwise for this display

Turn it anticlockwise and get the graphing display.

You can take pictures of the measurements.

No test lead wires!

Did I say $35 from Amazon?

Extra
ANENG 681

Color model available
Form factor of phone
USB charging
Excellent display
Auto function
Well built and sturdy
$26 Best Bang/$

Meter Comparison- Expensive

Siglent 3045x- $300

- Best display and easiest to use, thumb drive storage
- Uses USB for remote program that works easily

Agilent 34410A- $500

- Best accuracy, internal program hard to use. Outstanding ext. program BenchVue Basic (live graphing) LAN or Wi-Fi- USB

UT181A $290

- Hand held, versatile, great display, accurate, many measurements and very fast. Unique bar graph.
- Internal graph, easy and excellent interface and program
- Graph after data on meter, but same time in ext. program
- Bluetooth app works perfectly for Android and Apple.

UT61E+ $85

- Like the 181- but no internal data logging or dBm.
- Use Bluetooth and ext. program and ACV for logging.

Meter comparison- Cheap

- **Uni-t UT61BT- $37**
  - Well built , good range, internal BT Good prog.
- **AN9002- $28**
  - Cheaply made, Great Prog. internal BT
- **Pencil DMM- $35**
  - A no brainer. No test lead DMM. Buy it.

Results

- **Worthwhile changes-**
  - The addition of data logging and graphing programs.
  - USB and LAN connections that are easy to use.
  - Remote program via Bluetooth to phone.
- **Next Steps?**
  - More phone based apps via Bluetooth 5.3
  - Wi-Fi to router to a laptop's Wi-Fi input to run Programs via Wi-Fi.

Example- Sun-Moon Noise

- Use a power meter like an HP437A or Anritsu ML4803A with averaging.
- Use a data logging DMM like the UT 181A at the recorder output of the power meter
- Use BlueTooth to link to a phone for live Graphing and storage.

Antenna Data

60db gain
Put signals
Higher in
The sensor's
Power
range

At The Antenna

Conclusions

- The **Siglent 3045x** is an excellent lab meter with an easy to use USB program. Thumb drive storage.
- A good combination for bench and portable are the **Siglent 3045x** and **UT61E+**
- If you bought just one meter, the **Uni-T 181A** would be a good choice.
- Buy the Pencil DMM for $35. No brainer.

Time for Questions

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Many Thanks to Oliver KB6BA for his work on
Measuring moon noise with small dishes.